



FIGURE 5.18. The effect of differentially rooting the three-domain Tree of Life on inferred properties of LUCA. (A) Three different rootings of the Tree of Life. (B) The rooted forms of these trees. (C) The presence (red circle) or absence (blue filled circle) of the nuclear membrane overlaid onto the rooted trees. (D,E) Evolutionary character state reconstruction can be used to test different hypotheses about the origin of the nuclear membrane. (D) A reconstruction of the evolutionary gain and/or loss of the nuclear membrane if it is assumed that the membrane is derived. (E) A reconstruction of the evolutionary gain and/or loss of the nuclear membrane if it is assumed that the membrane is ancestral. For each rooting, D and E can be compared to see if one is more parsimonious. When the root is in either the bacterial or archaeal lineage, the derived-membrane scenario requires fewer evolutionary events and thus is more parsimonious. When the root is in the eukaryotic lineage, the derived scenario is also more parsimonious but only slightly so because the ancestral scenario simply requires the loss of the nuclear membrane in the ancestor of the bacteria and archaea.